FIG.1A

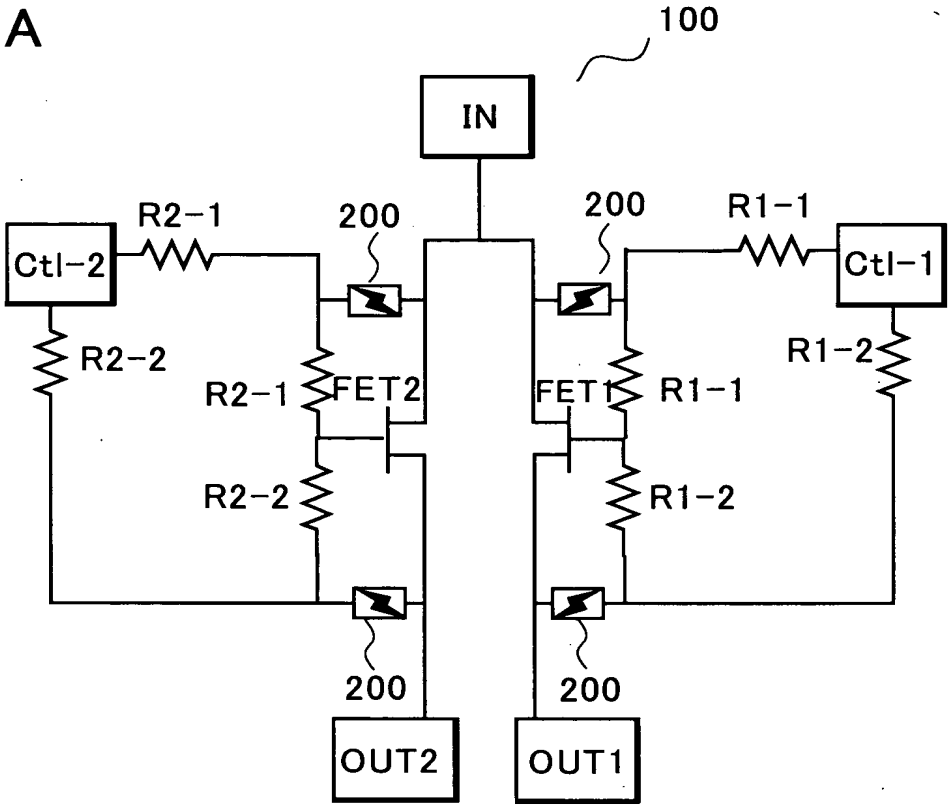
100
IN
R2-1
200
200
R1-1
Ctl-2
Ctl-1
R2-2
R1-2
R2-1
FET2
FET1
R1-1
R2-2
R1-2
200
200
OUT2
OUT1

FIG.1B

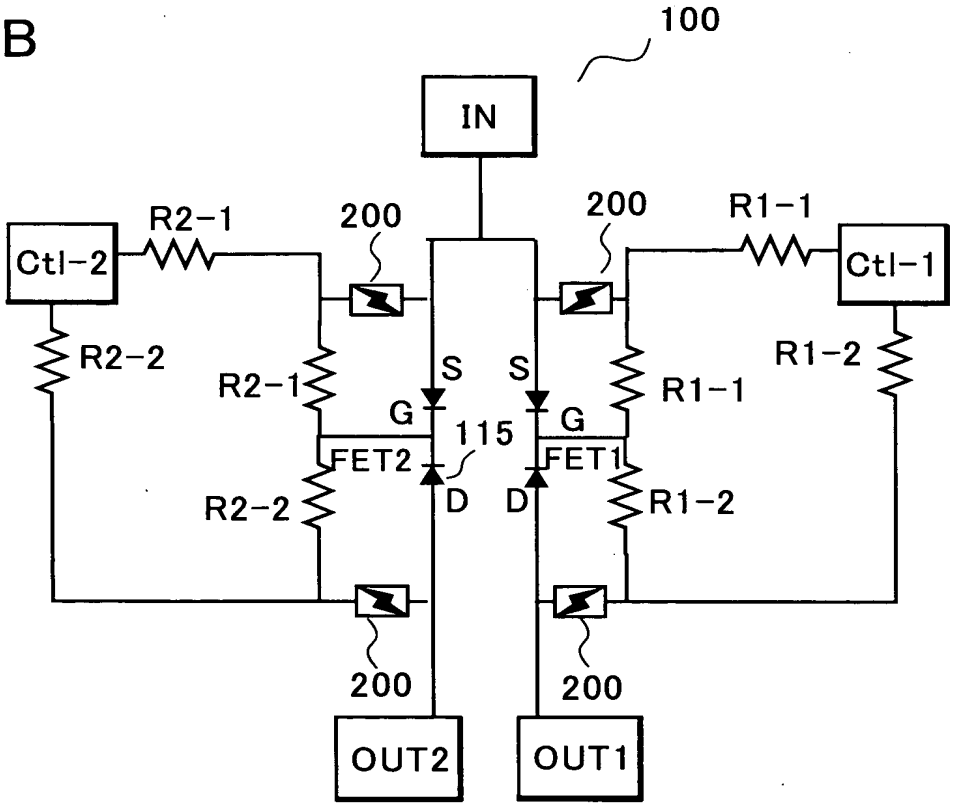
100
IN
R2-1
200
200
R1-1
Ctl-2
Ctl-1
R2-2
R1-2
R2-1
S
S
R1-1
G
G
115
FET2
FET1
R2-2
D
D
R1-2
200
200
OUT2
OUT1

FIG.2

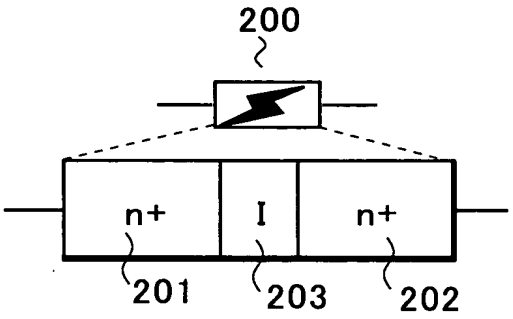

FIG.3A

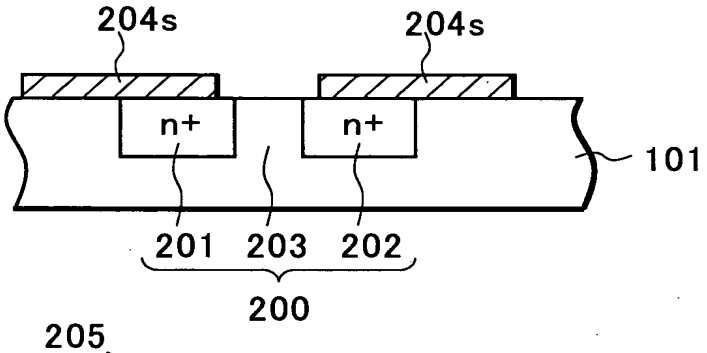

FIG.3B

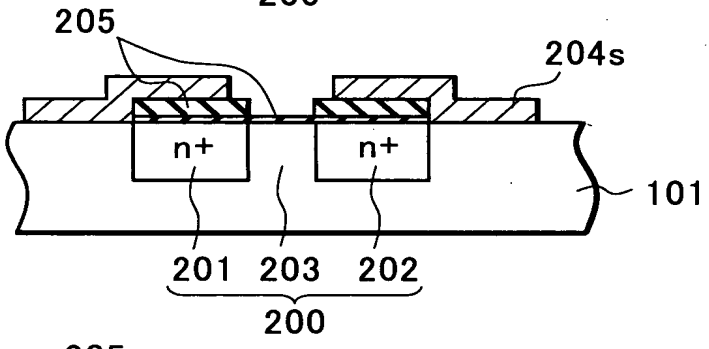

FIG.3C

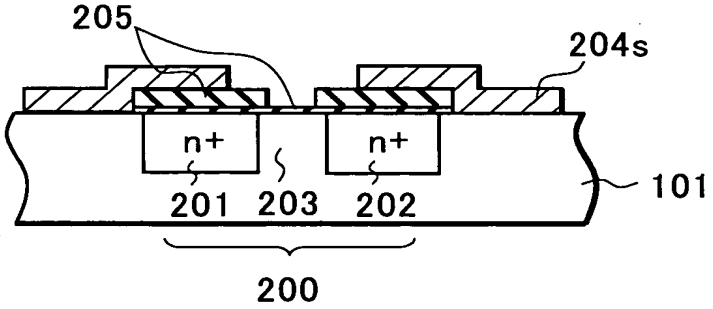

FIG.3D

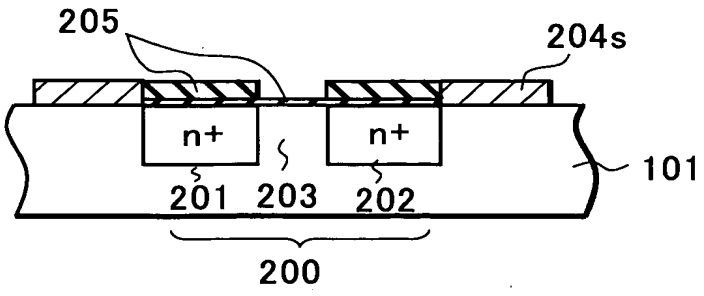

FIG.4A

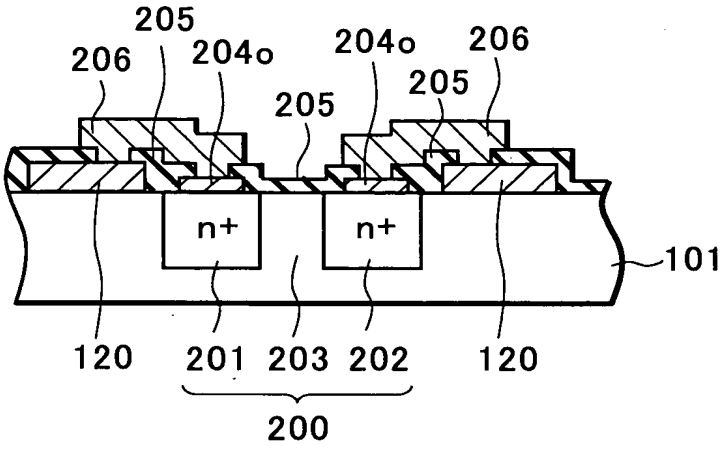
205
206
204o
204o
206
205
205
n+
n+
101
120
201
203
202
120
200

FIG.4B

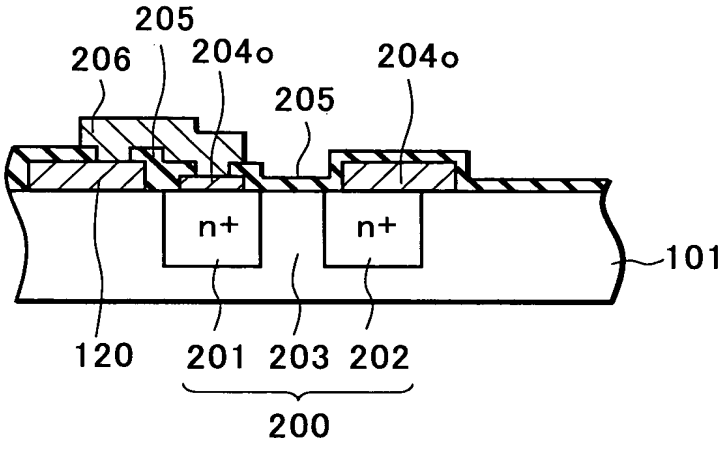
205
206
204o
204o
205
n+
n+
101
120
201
203
202
200

FIG.5A

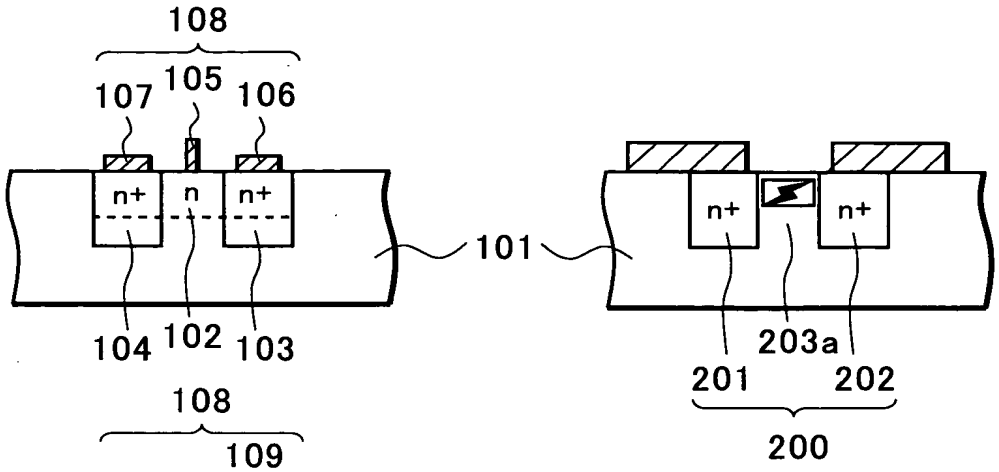

FIG.5B

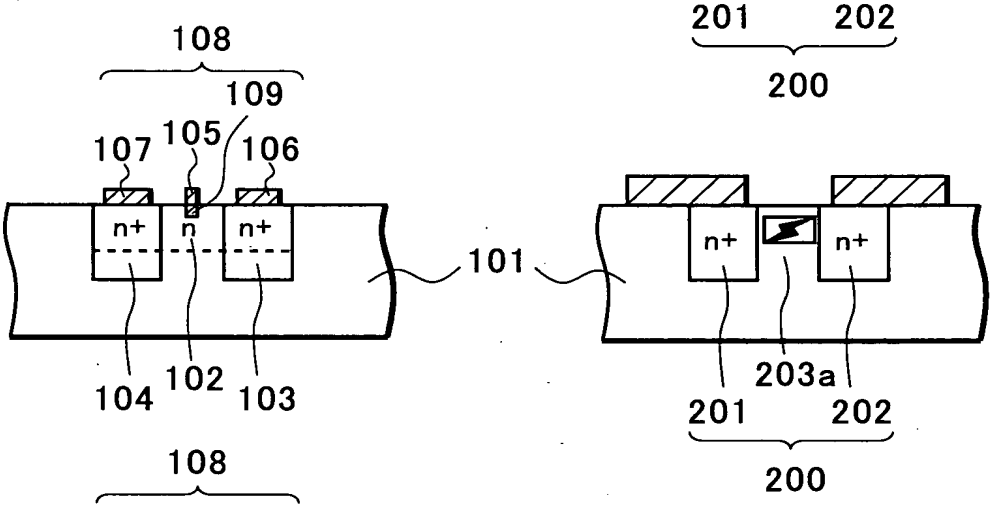

FIG.5C

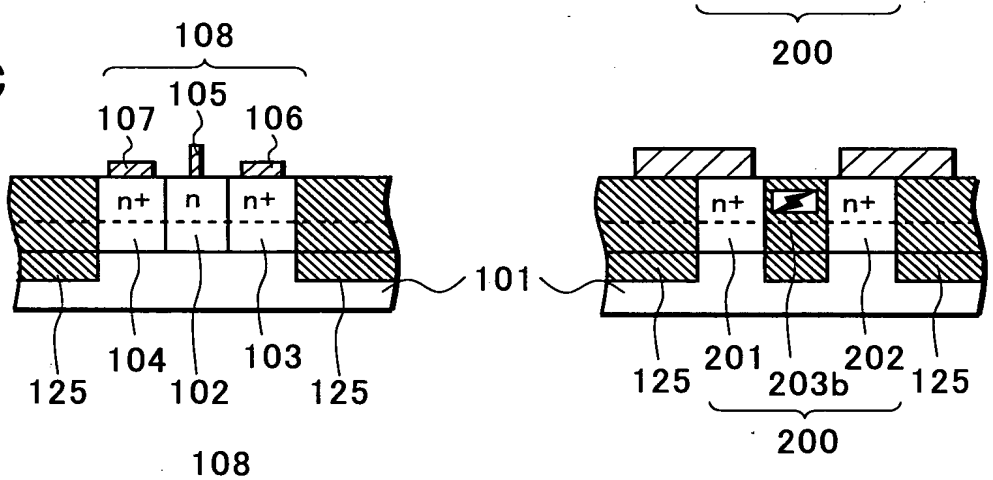

FIG.5D

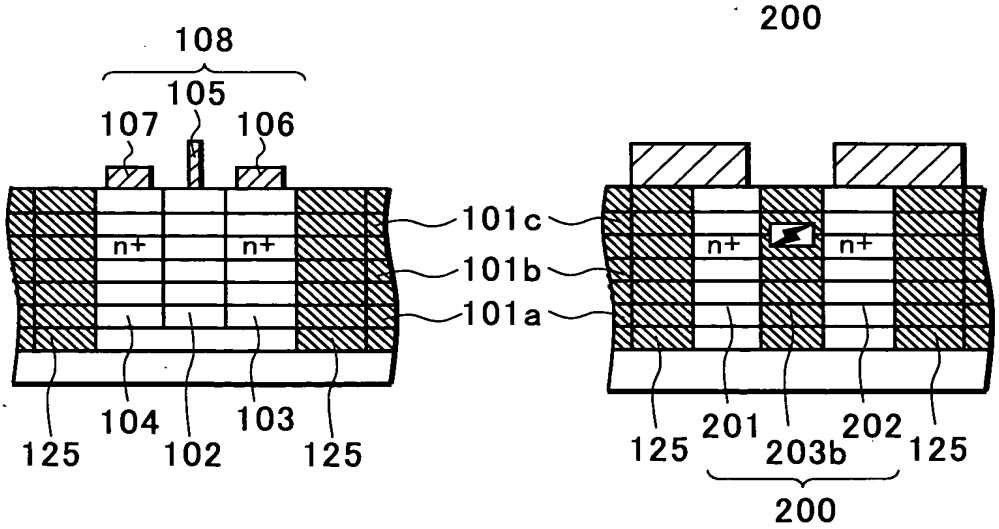

FIG.6

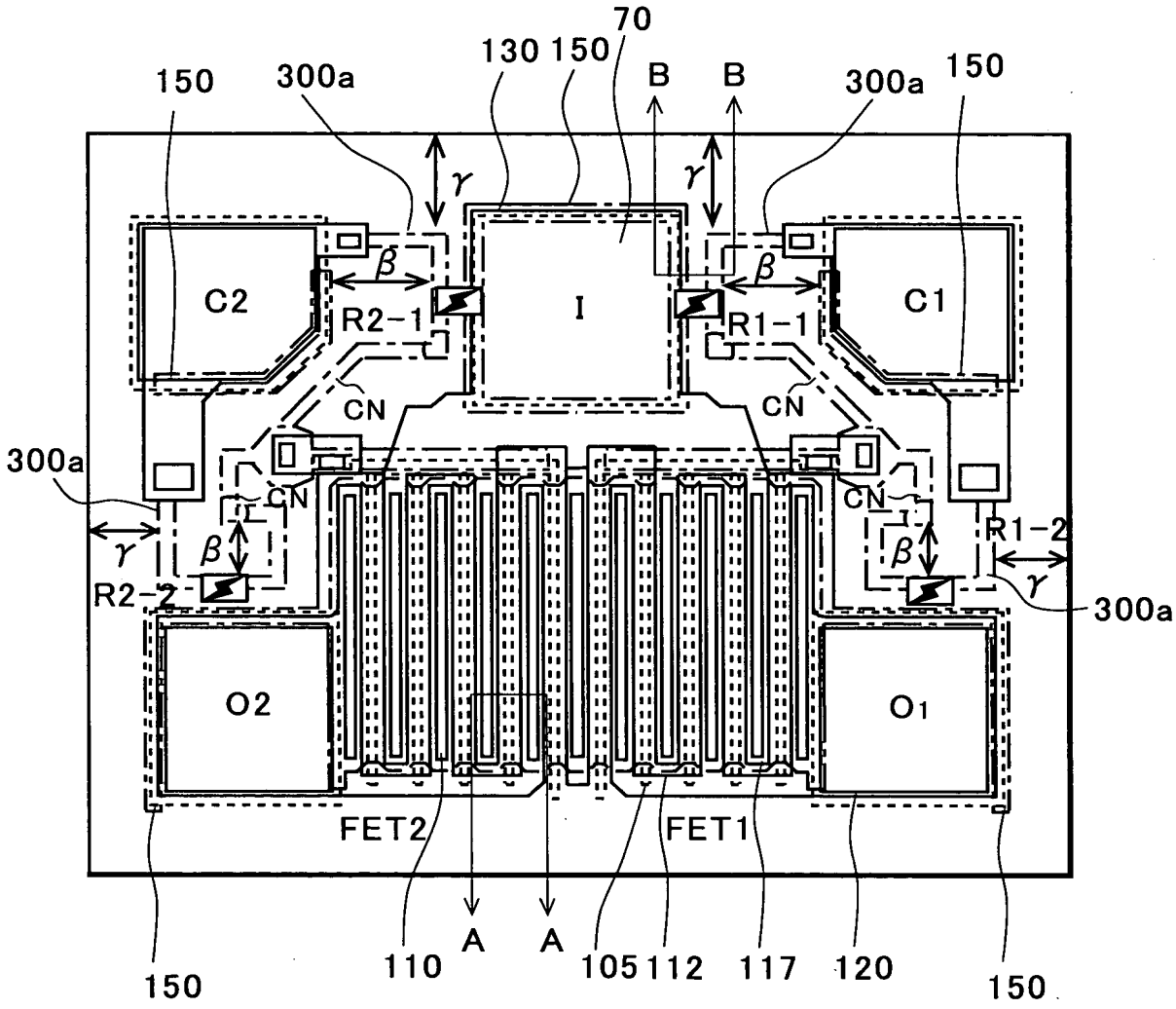
70
130
150
150
300a
B
B
300a
150
γ
γ
β
β
C2
R2-1
I
R1-1
C1
CN
CN
300a
CN
CN
R1-2
γ
β
β
γ
R2-2
300a
O2
O1
FET2
FET1
150
110
A
A
105
112
117
120
150

FIG.7A

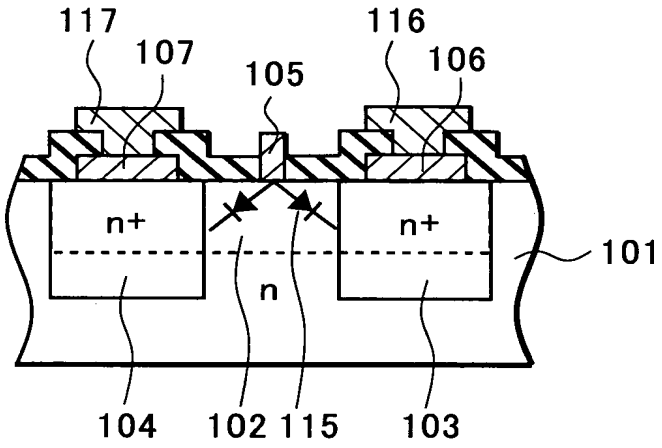
117
107
105
116
106
n+
n+
101
n
104
102
115
103

FIG.7B

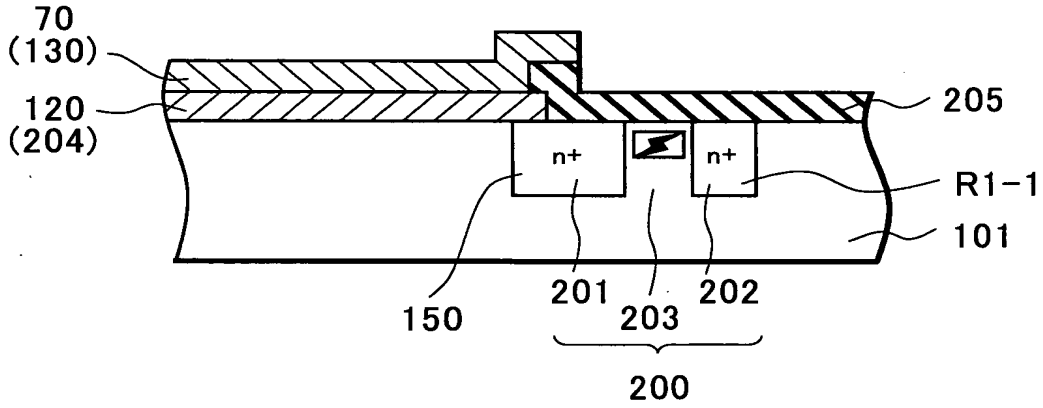
70
(130)
120
(204)
205
n+
n+
R1-1
101
150
201
203
202
200

FIG.8

Electrostatic withstand voltage
across respective terminals (unit: V)

IN — Ctl-1	700
IN — Ctl-2	700
OUT1 — Ctl-1	700
OUT2 — Ctl-2	700

FIG.9

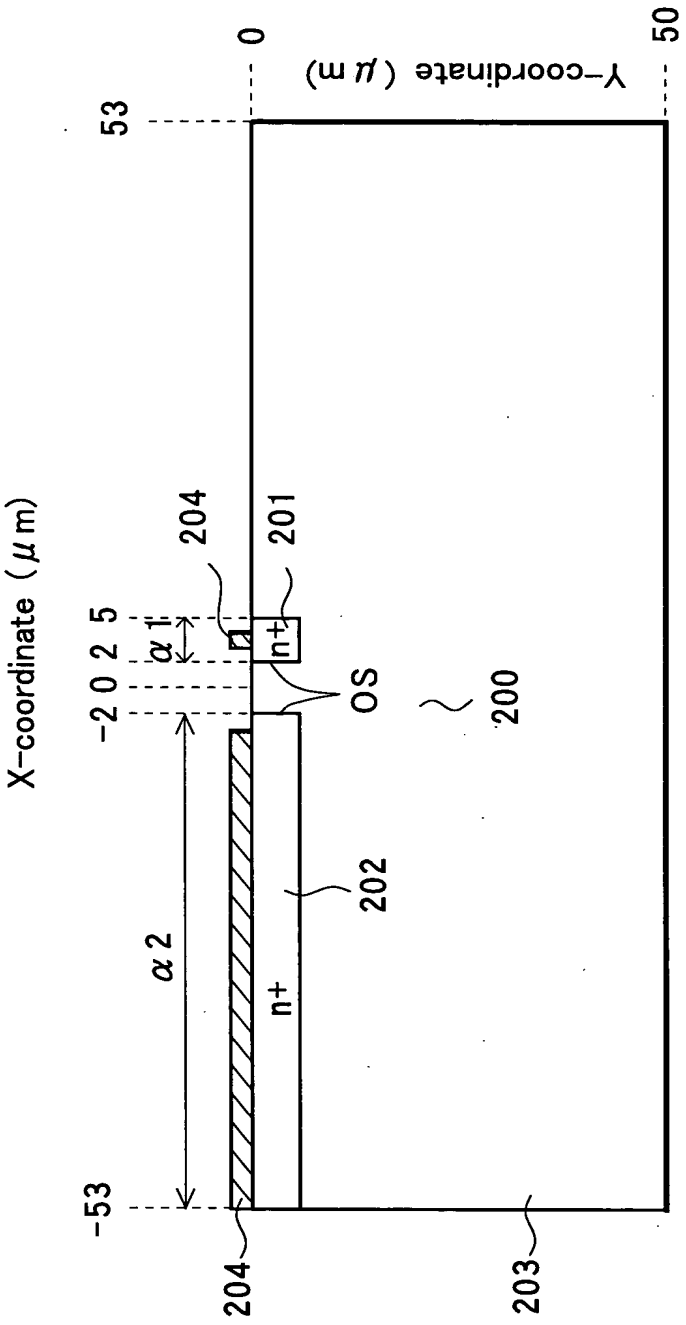
0
50
Y-coordinate (μm)
53
X-coordinate (μm)
204
201
25
α1
n+
-20
OS
200
202
α2
n+
-53
204
203

FIG.10

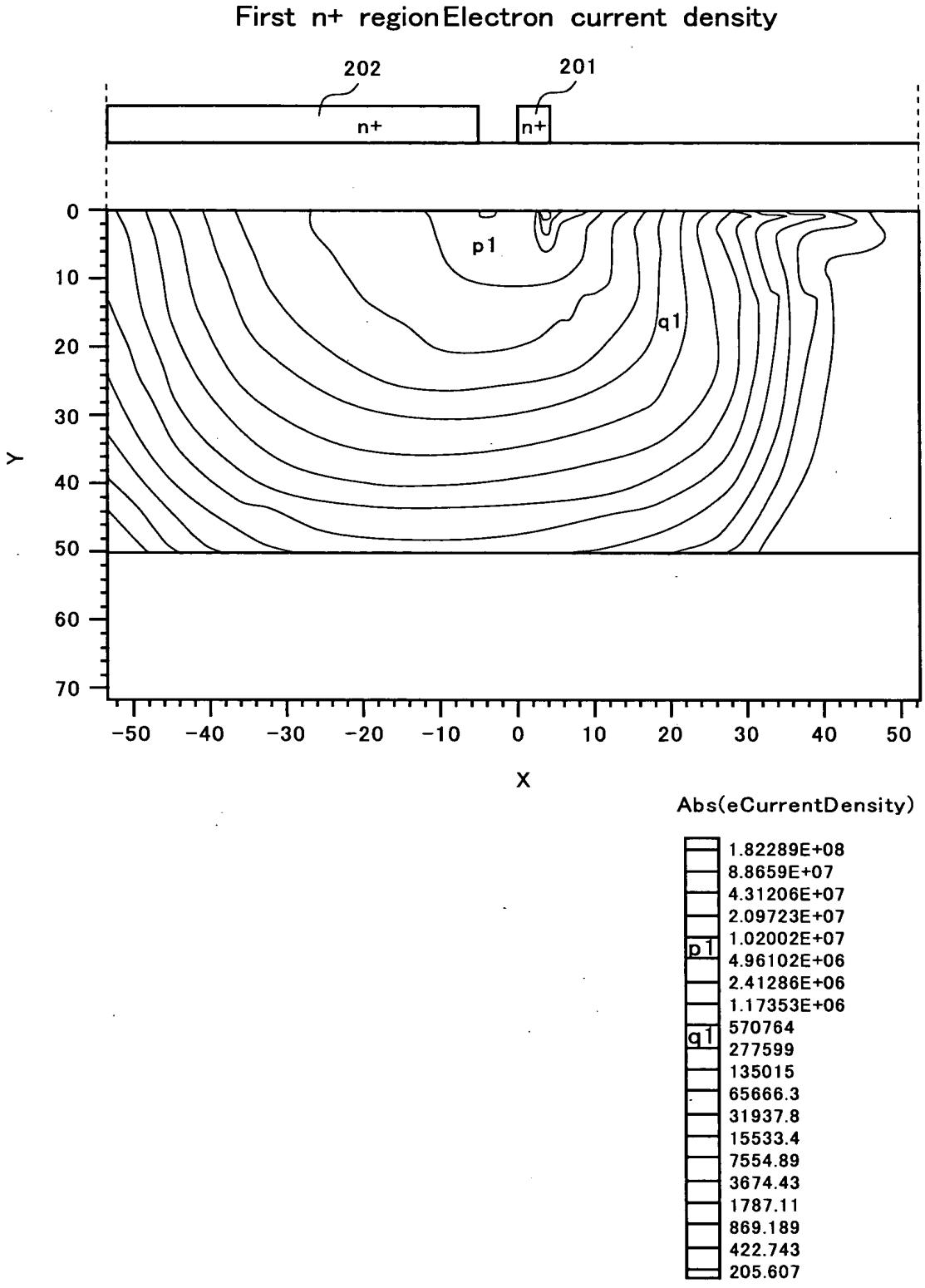
First n+ regionElectron current density
202
201
n+
n+
p1
q1
0
10
20
30
40
50
60
70
Y
-50
-40
-30
-20
-10
0
10
20
30
40
50
X
Abs(eCurrentDensity)
1.82289E+08
8.8659E+07
4.31206E+07
2.09723E+07
1.02002E+07
p1
4.96102E+06
2.41286E+06
1.17353E+06
570764
q1
277599
135015
65666.3
31937.8
15533.4
7554.89
3674.43
1787.11
869.189
422.743
205.607

FIG.11

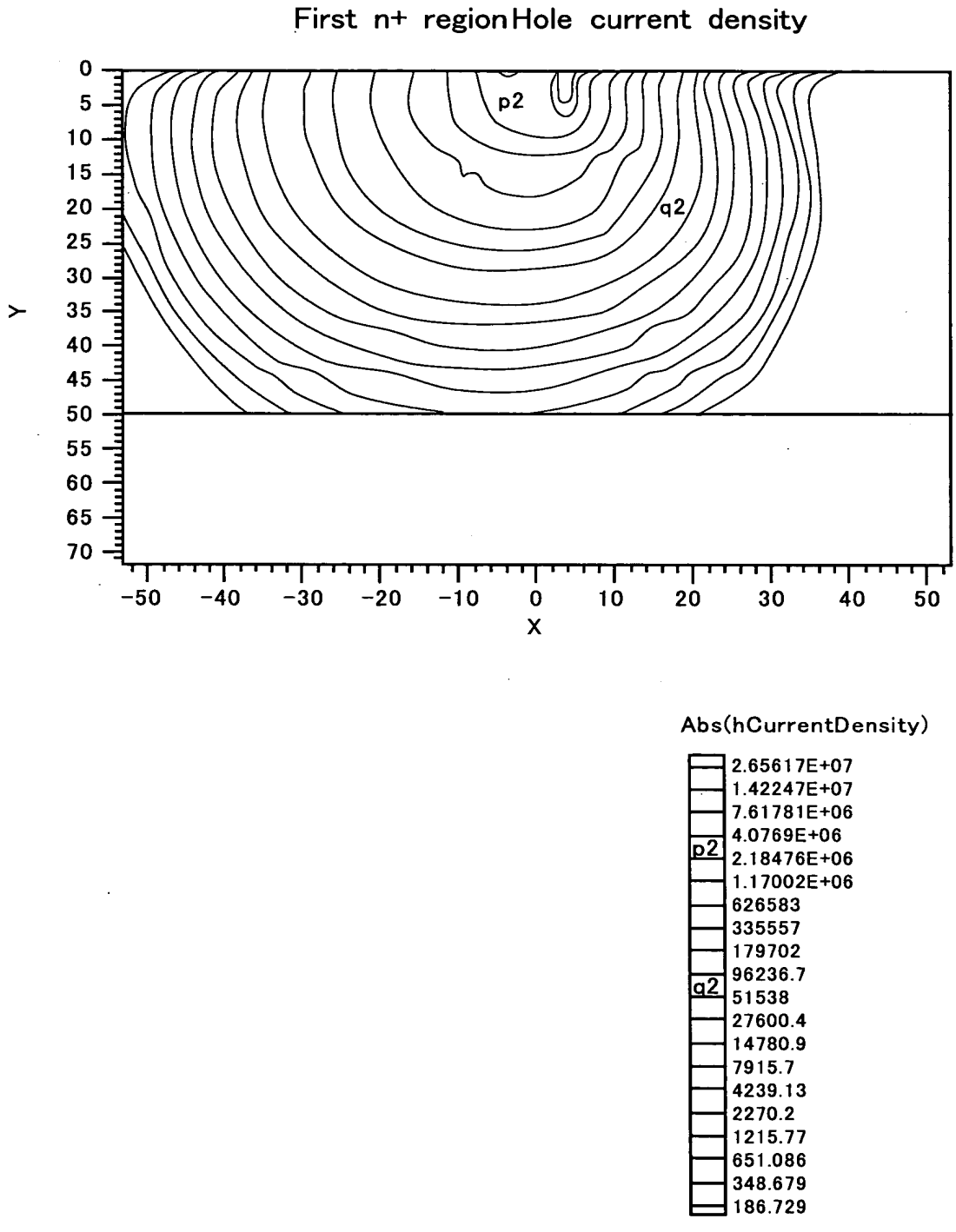
First n+ regionHole current density
p2
q2
Y
X
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
-50
-40
-30
-20
-10
0
10
20
30
40
50
Abs(hCurrentDensity)
2.65617E+07
1.42247E+07
7.61781E+06
4.0769E+06
p2
2.18476E+06
1.17002E+06
626583
335557
179702
96236.7
q2
51538
27600.4
14780.9
7915.7
4239.13
2270.2
1215.77
651.086
348.679
186.729

FIG.12

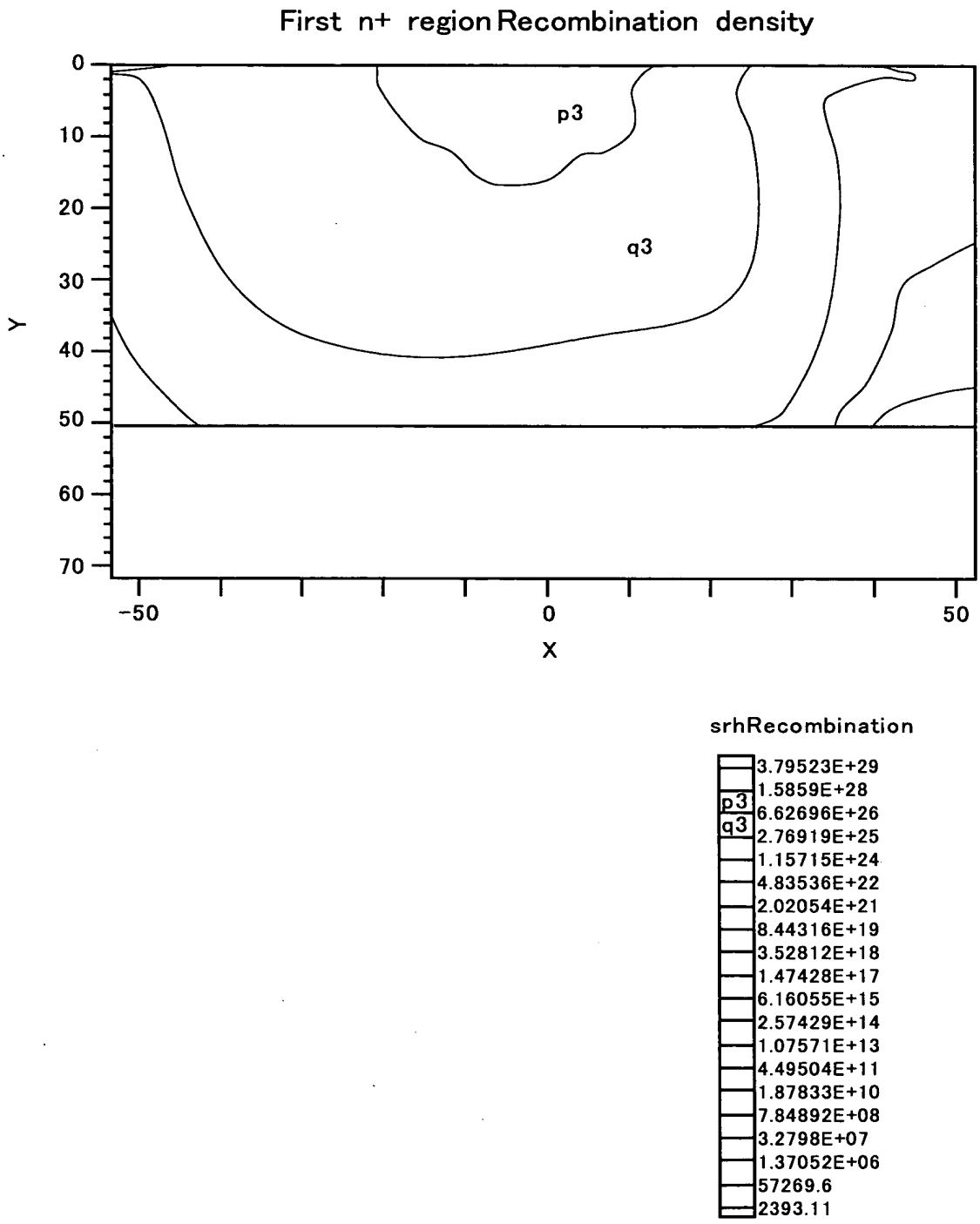
First n+ region Recombination density
p3
q3
0
10
20
30
40
50
60
70
Y
-50
0
50
X
srhRecombination
3.79523E+29
1.5859E+28
p3
6.62696E+26
q3
2.76919E+25
1.15715E+24
4.83536E+22
2.02054E+21
8.44316E+19
3.52812E+18
1.47428E+17
6.16055E+15
2.57429E+14
1.07571E+13
4.49504E+11
1.87833E+10
7.84892E+08
3.2798E+07
1.37052E+06
57269.6
2393.11

FIG.13A

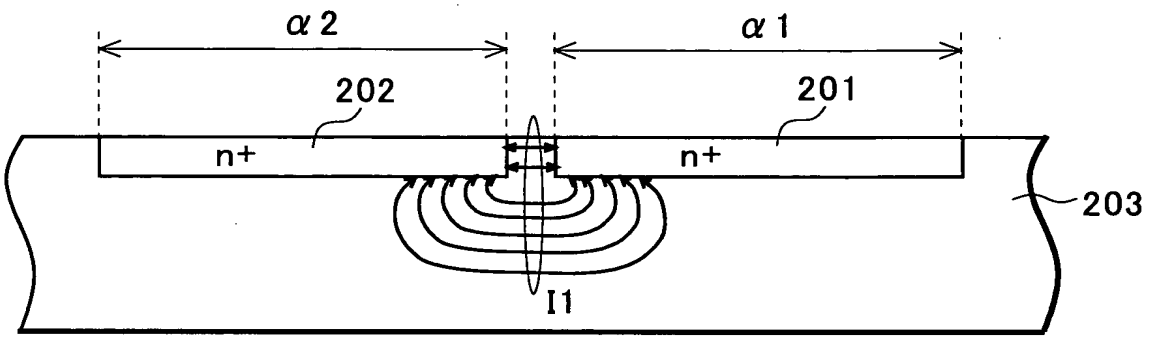

FIG.13B

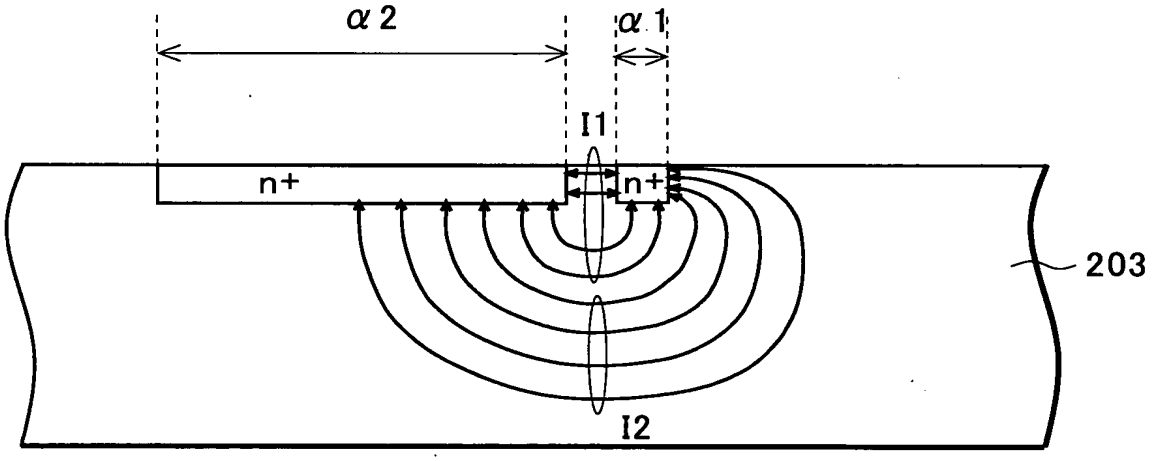

FIG.14

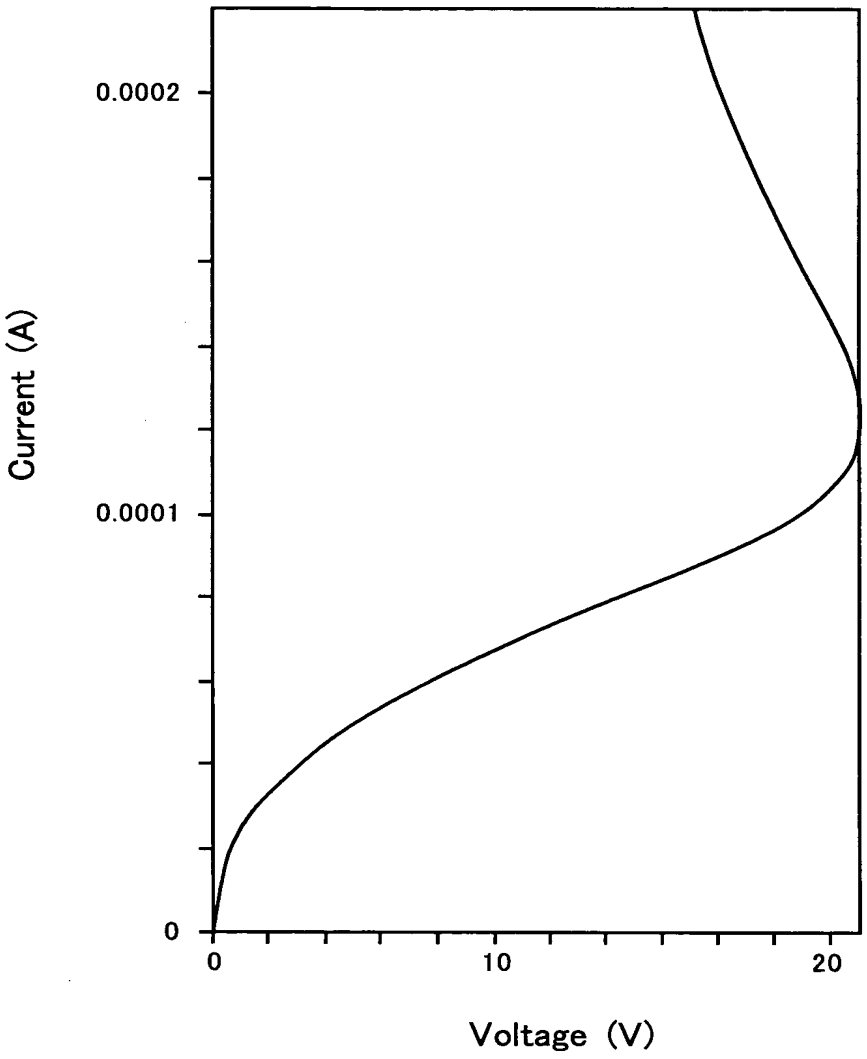

FIG.15

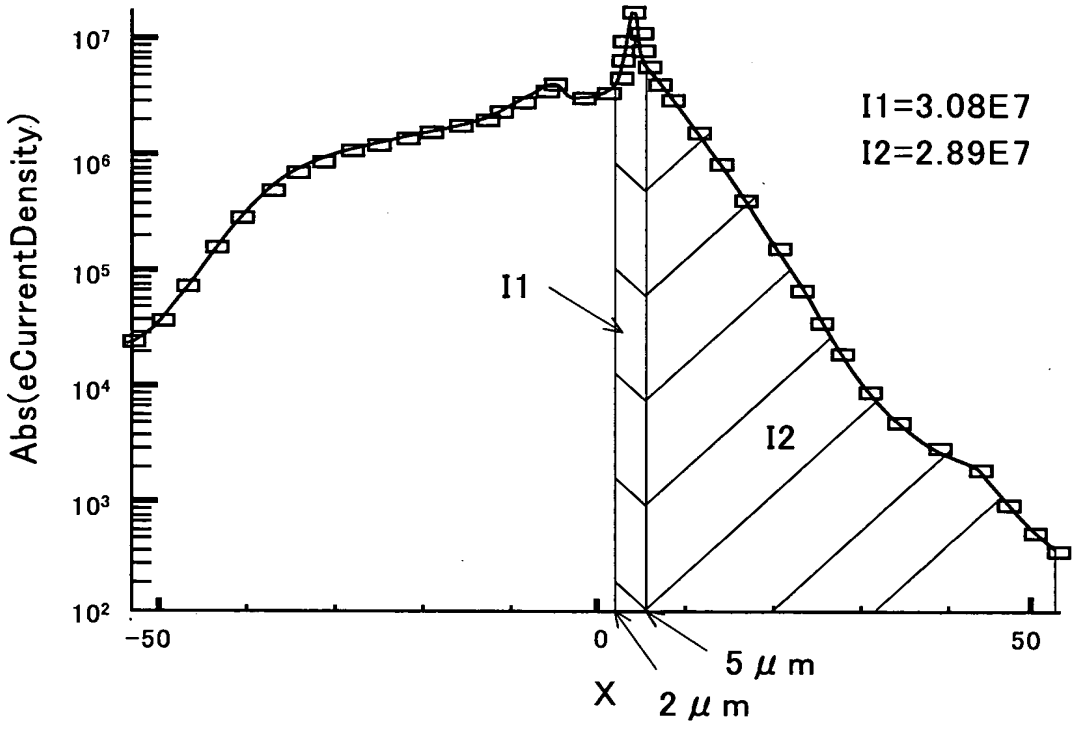
Abs(eCurrentDensity)
10⁷
10⁶
10⁵
10⁴
10³
10²
-50
0
50
X
I1=3.08E7
I2=2.89E7
I1
I2
5 μ m
2 μ m

FIG.16A

Comparison of spreading of currents and recombination

	a-structure			b-structure-1			b-structure-2		
Electron current density	y__2	x__0	Product	y__2	x__0	Product	y__2	x__0	Product
	21.9	10.5	230.0	26	15	390.0	23.8	11.3	268.9
Hole current density	y__2	x__0		y__2	x__0		y__2	x__0	
	13.7	6	82.2	23.9	12.5	298.8	12.7	7.4	94.0
Recombination density	y__2	x__0		y__2	x__0		y__2	x__0	
	29.7	14.8	439.6	33.1	20	662.0	33.9	15.5	525.5

FIG.16B

b-structure-3		
y__2	x__0	Product
69	36.1	2490.9
y__2	x__0	
47.9	29.1	1393.9
y__2	x__0	
80 or more	43.9	3512 or more

FIG.16C

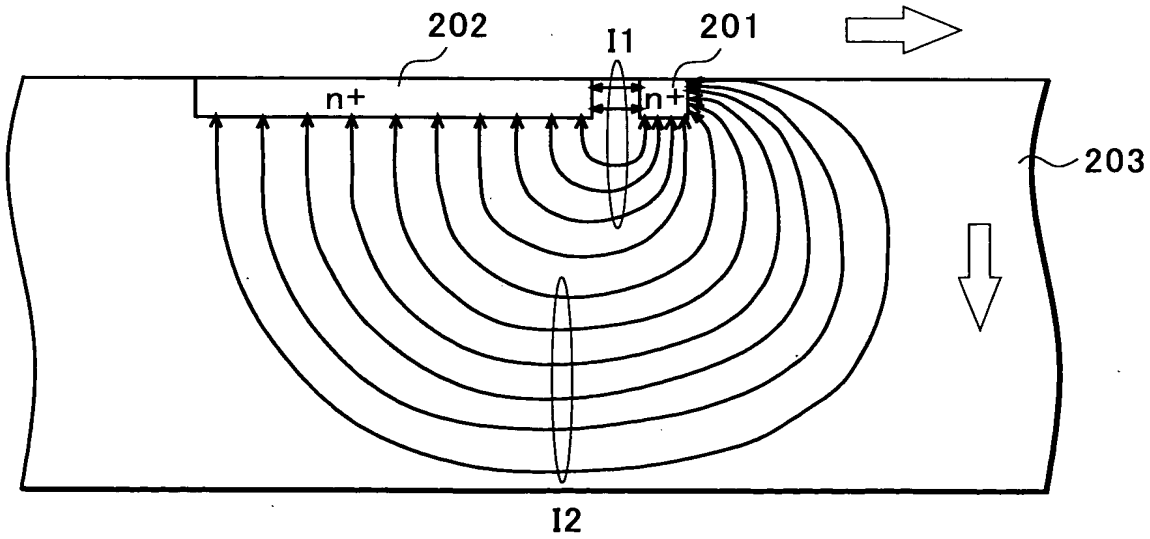

FIG.17

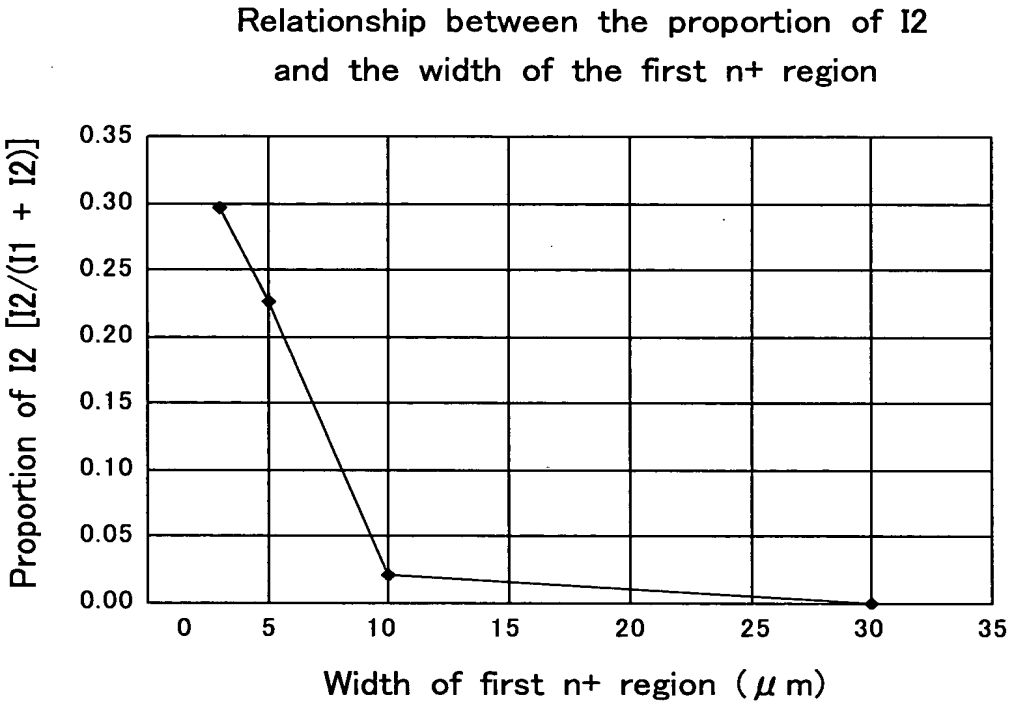
Relationship between the proportion of I2
and the width of the first n+ region
Proportion of I2 [I2/(I1 + I2)]
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
5
10
15
20
25
30
35
Width of first n+ region (μm)

FIG.18A

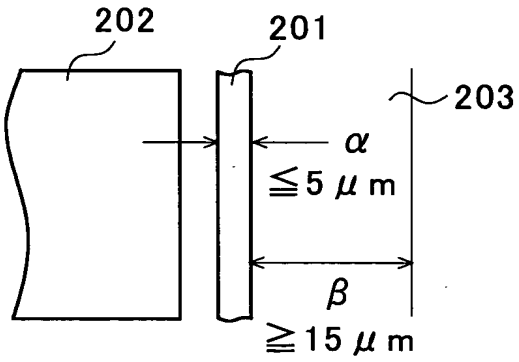

FIG.18B

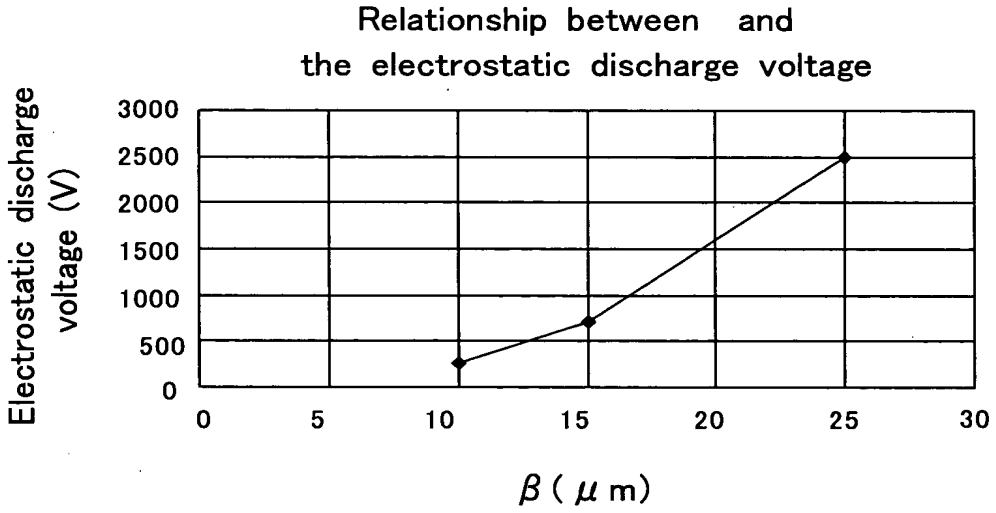

FIG.19A

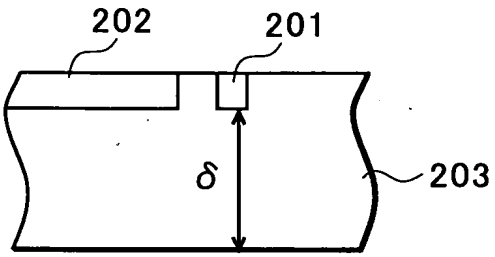

FIG.19B

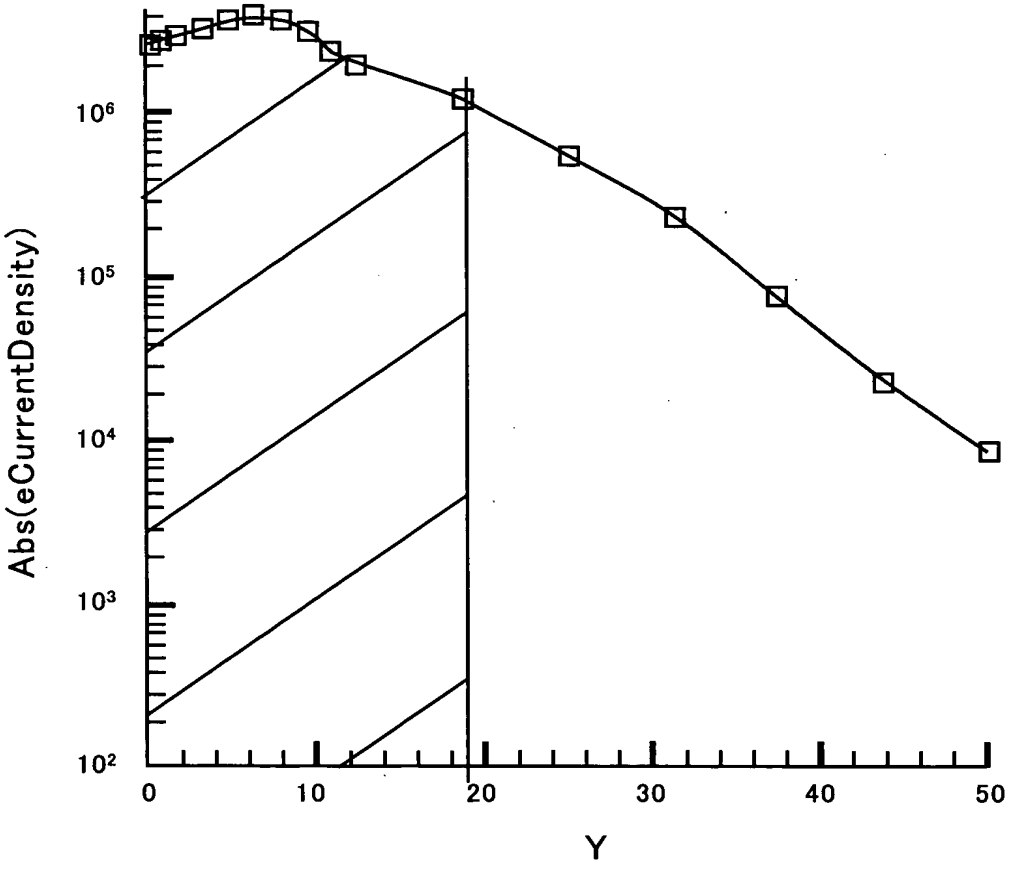

FIG.20A

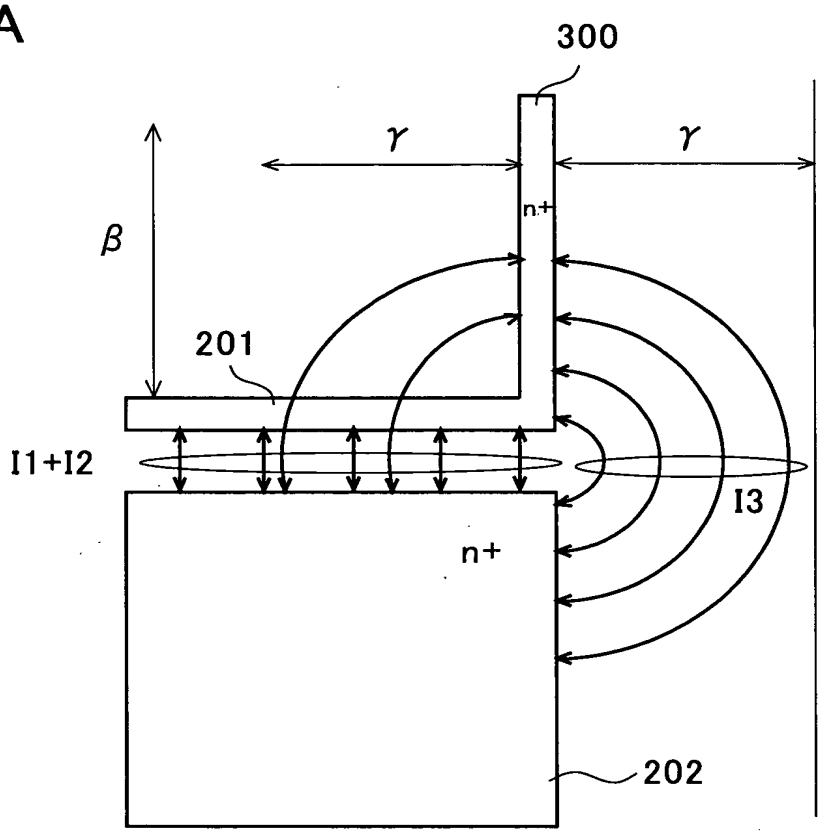

FIG.20B

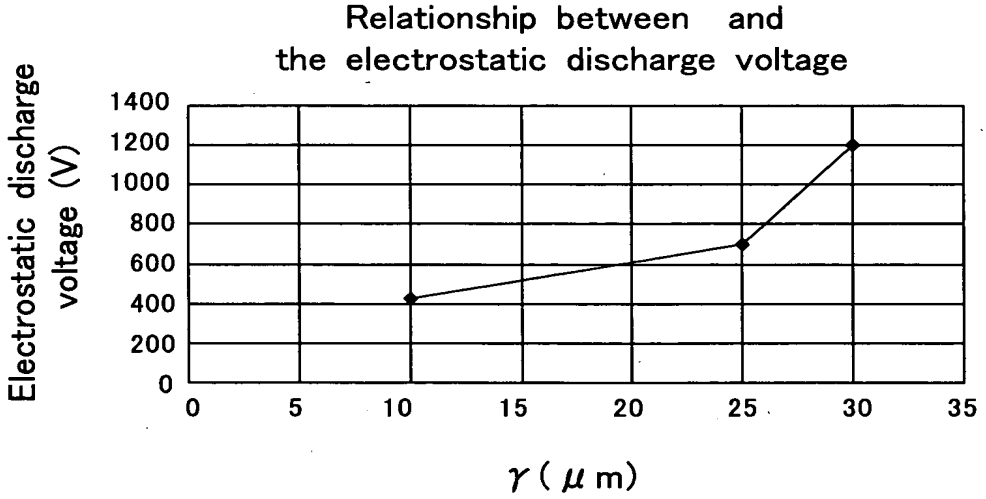

FIG.21

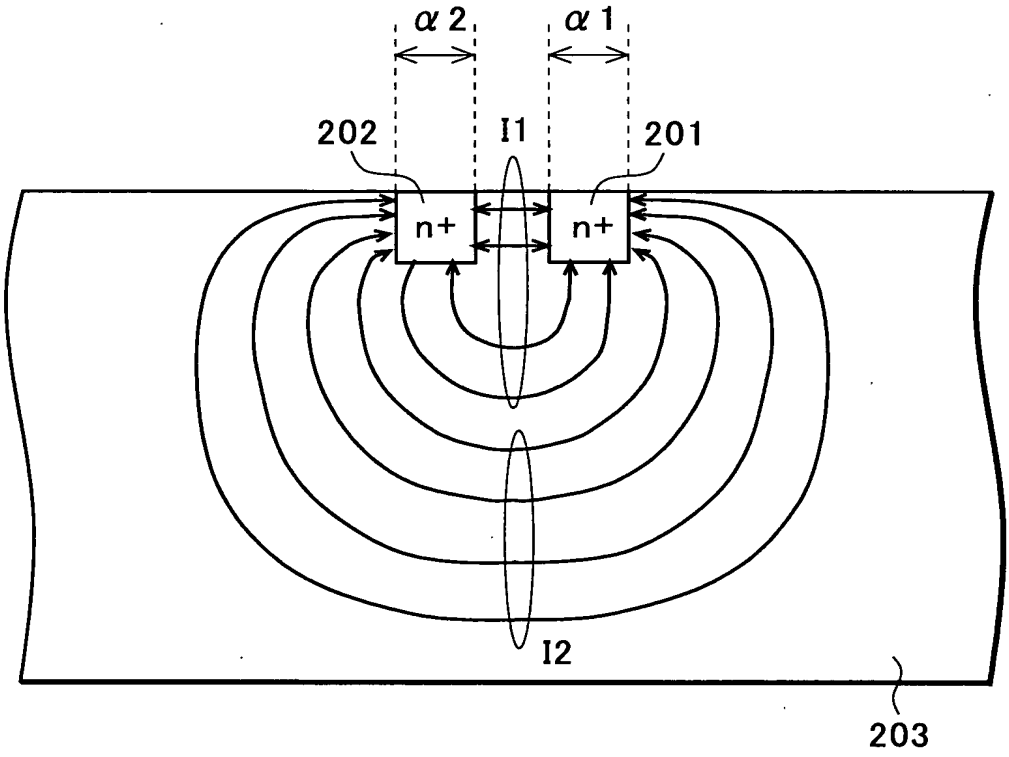

FIG.22

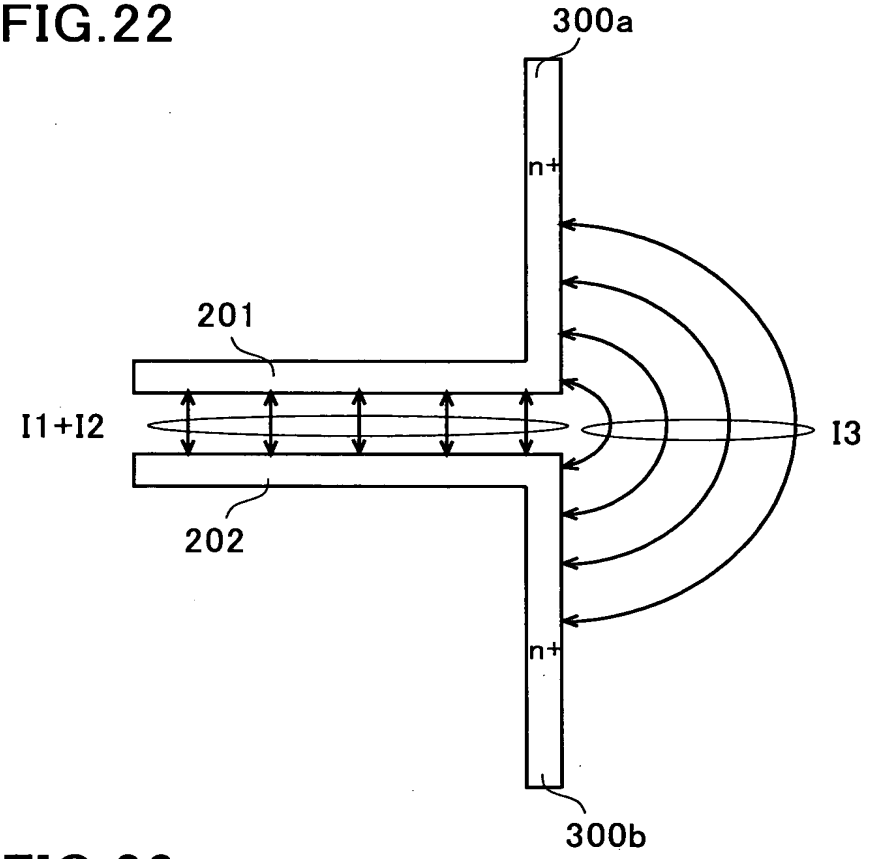
300a
n+
201
I1+I2
I3
202
n+
300b

FIG.23

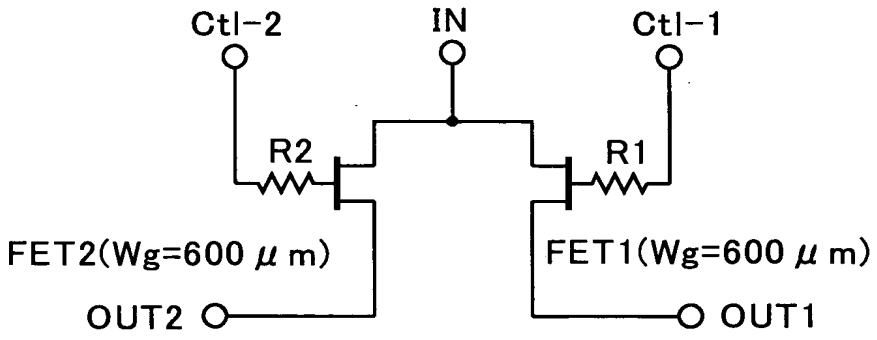
Ctl-2
IN
Ctl-1
R2
R1
FET2(Wg=600 μm)
FET1(Wg=600 μm)
OUT2
OUT1

FIG.24

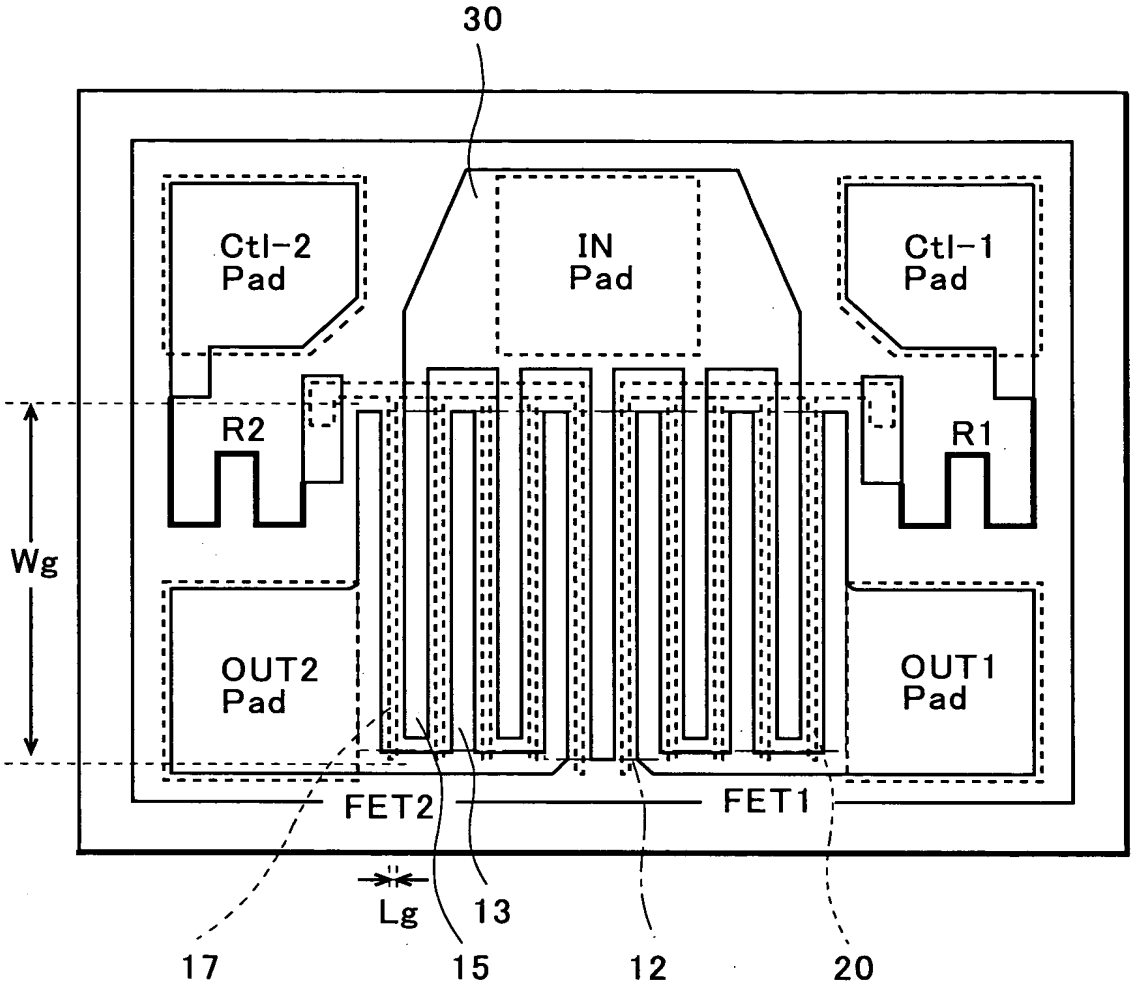

FIG.25

Electrostatic withstand voltage across respective terminals (unit: V)

IN — Ctl-1	140
IN — Ctl-2	140
OUT1 — Ctl-1	500
OUT2 — Ctl-2	450